

LM2904, LM2904A

Low-power dual operational amplifier

Features

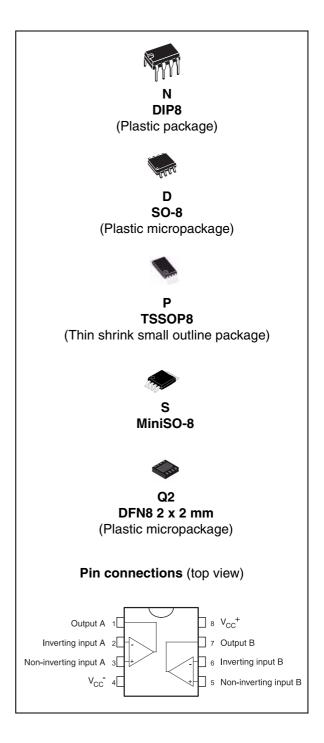
- Internally frequency-compensated
- Large DC voltage gain: 100 dB
- Wide bandwidth (unity gain): 1.1 MHz (temperature compensated)
- Very low supply current/amplifier, essentially independent of supply voltage
- Low input bias current: 20 nA (temperature compensated)
- Low input offset current: 2 nA
- Input common-mode voltage range includes negative rail
- Differential input voltage range equal to the power supply voltage
- Large output voltage swing 0 V to (V_{CC+} -1.5 V)

Description

This circuit consists of two independent, high gain, internally frequency-compensated operational amplifiers designed specifically for automotive and industrial control systems. It operates from a single power supply over a wide range of voltages. The low power supply drain is independent of the magnitude of the power supply voltage.

Application areas include transducer amplifiers, DC gain blocks and all the conventional op-amp circuits which can now be more easily implemented in single power supply systems. For example, these circuits can be directly supplied from the standard +5 V which is used in logic systems and easily provides the required interface electronics without requiring any additional power supply.

In the linear mode, the input common-mode voltage range includes ground and the output voltage can also swing to ground, even though operated from a single power supply.



Contents LM2904, LM2904A

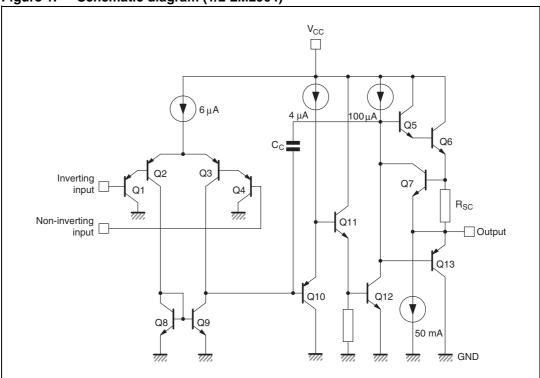
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LM2904, LM2904A Schematic diagram

1 Schematic diagram

Figure 1. Schematic diagram (1/2 LM2904)



2 Absolute maximum ratings and operating conditions

Table 1. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|-------------------|--|---|------|
| V _{CC} | Supply voltage ⁽¹⁾ | ±16 or 32 | V |
| V _{id} | Differential input voltage ⁽²⁾ | ±32 | V |
| V _{in} | Input voltage | -0.3 to 32 | V |
| | Output short-circuit duration (3) | Infinite | s |
| I _{in} | Input current ⁽⁴⁾ : V _{in} driven negative | 5 mA in DC or 50 mA in AC (duty cycle = 10%, T = 1s) | mA |
| | Input current ⁽⁵⁾ : V _{in} driven positive above AMR value | 0.4 | |
| T _{oper} | Operating free-air temperature range | -40 to +125 | °C |
| T _{stg} | Storage temperature range | -65 to +150 | °C |
| Tj | Maximum junction temperature | 150 | °C |
| R _{thja} | Thermal resistance junction to ambient ⁽⁶⁾ SO-8 TSSOP8 DIP8 MiniSO-8 DFN8 2x2 | 125 120 85 190 57 | °C/W |
| R _{thjc} | Thermal resistance junction to case ⁽⁶⁾ SO-8 TSSOP8 DIP8 MiniSO-8 | 40 37 41 39 | °C/W |
| | HBM: human body model ⁽⁷⁾ | 300 | V |
| ESD | MM: machine model ⁽⁸⁾ | 200 | V |
| | CDM: charged device model ⁽⁹⁾ | 1.5 | kV |

- 1. All voltage values, except differential voltage are with respect to network ground terminal.
- 2. Differential voltages are the non-inverting input terminal with respect to the inverting input terminal.
- Short-circuits from the output to V_{CC} can cause excessive heating if V_{cc+} > 15 V. The maximum output current is approximately 40 mA, independent of the magnitude of V_{CC}.
 Destructive dissipation can result from simultaneous short-circuits on all amplifiers.
- 4. This input current only exists when the voltage at any of the input leads is driven negative. It is due to the collector-base junction of the input PNP transistor becoming forward-biased and thereby acting as input diode clamp. In addition to this diode action, there is NPN parasitic action on the IC chip. This transistor action can cause the output voltages of the Opamps to go to the V_{CC} voltage level (or to ground for a large overdrive) for the time during which an input is driven negative. This is not destructive and normal output is restored for input voltages above -0.3 V.
- 5. The junction base/substrate of the input PNP transistor polarized in reverse must be protected by a resistor in series with the inputs to limit the input current to 400 μ A max (R = (Vin-32 V)/400 μ A).
- 6. Short-circuits can cause excessive heating and destructive dissipation. Values are typical.
- 7. Human body model: a 100 pF capacitor is charged to the specified voltage, then discharged through a 1.5 k Ω resistor between two pins of the device. This is done for all couples of connected pin combinations while the other pins are floating.
- Machine model: a 200 pF capacitor is charged to the specified voltage, then discharged directly between two pins of the
 device with no external series resistor (internal resistor < 5 Ω). This is done for all couples of connected pin combinations
 while the other pins are floating.
- 9. Charged device model: all pins and the package are charged together to the specified voltage and then discharged directly to the ground through only one pin. This is done for all pins.

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Table 2. Operating conditions

| Symbol | Parameter | Value | Unit |
|-------------------|--------------------------------------|-----------------------------|------|
| V _{CC} | Supply voltage | 3 to 30 | V |
| V _{icm} | Common mode input voltage range | 0 to V _{CC+} - 1.5 | V |
| T _{oper} | Operating free-air temperature range | -40 to +125 | °C |

3 Electrical characteristics

Table 3. $V_{CC+} = 5 \text{ V}, V_{CC-} = \text{ground}, V_O = 1.4 \text{ V}, T_{amb} = 25^{\circ} \text{ C}$ (unless otherwise specified)

| Symbol | Parameter | Min. | Тур. | Max. | Unit |
|---------------------|--|----------------------|----------|--|----------|
| V _{io} | Input offset voltage $^{(1)}$ $T_{amb} = 25^{\circ} \text{ C LM2904}$ $T_{amb} = 25^{\circ} \text{ C LM2904A}$ $T_{min} \leq T_{amb} \leq T_{max} \text{ LM2904}$ $T_{min} \leq T_{amb} \leq T_{max} \text{ LM2904A}$ | | 2 1 | 7 2 9 4 | mV |
| DV _{io} | Input offset voltage drift | | 7 | 30 | μV/°C |
| I _{io} | Input offset current $T_{amb} = 25^{\circ} C$ $T_{min} \le T_{amb} \le T_{max}$ | | 2 | 30 40 | nA |
| DI _{io} | Input offset current drift | | 10 | 300 | pA/°C |
| l _{ib} | Input bias current $^{(2)}$ $T_{amb} = 25^{\circ} C$ $T_{min} \le T_{amb} \le T_{max}$ | | 20 | 150 200 | nA |
| A _{vd} | Large signal voltage gain $\begin{split} &V_{CC+}=+15 \text{ V, } R_L=2 \text{ k}\Omega \text{ V}_o=1.4 \text{ V to } 11.4 \text{ V} \\ &T_{amb}=25^{\circ} \text{ C} \\ &T_{min} \leq T_{amb} \leq T_{max} \end{split}$ | 50 25 | 100 | | V/mV |
| SVR | Supply voltage rejection ratio ($R_S \le 10 \text{ k}\Omega$) $T_{amb} = 25^{\circ} \text{ C}$ $T_{min} \le T_{amb} \le T_{max}$ | 65 65 | 100 | | dB |
| Icc | Supply current, all amp, no load $T_{amb} = 25^{\circ}\text{C}, \ V_{CC+} = +5 \ \text{V}$ $T_{min} \leq T_{amb} \leq T_{max}, \ V_{CC+} = +30 \ \text{V}$ | | 0.7 | 1.2 2 | mA |
| V _{icm} | Input common mode voltage range (V_{CC+} = +30 V) ⁽³⁾ $T_{amb} = 25^{\circ} C$ $T_{min} \le T_{amb} \le T_{max}$ | 0 | | V _{CC+} -1.5 V _{CC+} -2 | V |
| CMR | Common-mode rejection ratio ($R_S = 10 \text{ k}\Omega$) $T_{amb} = 25^{\circ} \text{ C}$ $T_{min} \le T_{amb} \le T_{max}$ | 70 60 | 85 | | dB |
| I _{source} | Output short-circuit current $V_{CC+} = +15 \text{ V}, V_o = +2 \text{ V}, V_{id} = +1 \text{ V}$ | 20 | 40 | 60 | mA |
| I _{sink} | Output sink current $V_O = 2 \text{ V}, V_{CC+} = +5 \text{ V}$ $V_O = +0.2 \text{ V}, V_{CC+} = +15 \text{ V}$ | 10 12 | 20 50 | | mΑ μΑ |
| V _{OH} | High level output voltage (V_{CC+} = + 30 V) T_{amb} = +25° C, R_L = 2 k Ω $T_{min} \le T_{amb} \le T_{max}$ T_{amb} = +25° C, R_L = 10 k Ω $T_{min} \le T_{amb} \le T_{max}$ | 26 26 27 27 | 27 28 | | ٧ |

Table 3. $V_{CC+} = 5 \text{ V}, V_{CC-} = \text{ground}, V_O = 1.4 \text{ V}, T_{amb} = 25^{\circ} \text{ C}$ (unless otherwise specified) (continued)

| Symbol | Parameter | Min. | Тур. | Max. | Unit |
|----------------------------------|--|------------|------|----------|--------|
| V _{OL} | Low level output voltage ($R_L = 10 \text{ k}\Omega$) $T_{amb} = +25^{\circ} \text{ C}$ $T_{min} \leq T_{amb} \leq T_{max}$ | | 5 | 20 20 | mV |
| SR | Slew rate $\begin{split} &V_{CC+}=15 \text{ V, } V_{in}=0.5 \text{ to } 3 \text{ V, } R_L=2 \text{ k}\Omega C_L=&100 \text{ pF,} \\ &\text{unity gain} \\ &T_{min}\leq &T_{amb}\leq &T_{max} \end{split}$ | 0.3 0.2 | 0.6 | | V/µs |
| GBP | Gain bandwidth product f = 100 kHz $V_{CC+} = 30 \text{ V}, V_{in} = 10 \text{ mV}, R_L = 2 \text{ k}\Omega, C_L = 100 \text{ pF}$ | 0.7 | 1.1 | | MHz |
| THD | Total harmonic distortion $f = 1 \text{ kHz, } A_V = 20 \text{ dB, } R_L = 2 \text{ k}\Omega, V_o = 2 \text{ V}_{pp}, \\ C_L = 100 \text{ pF, } V_{CC+} = 30 \text{ V}$ | | 0.02 | | % |
| e _n | Equivalent input noise voltage $f = 1 \text{ kHz}, R_S = 100 \Omega, V_{CC+} = 30 \text{ V}$ | | 55 | | nV/√Hz |
| V _{O1} /V _{O2} | Channel separation ⁽⁴⁾ 1 kHz ≤ f ≤ 20 kHz | | 120 | | dB |

^{1.} $V_O = 1.4 \text{ V}, \, R_S = 0 \, \Omega, \, 5 \, \text{V} < V_{CC+} < 30 \, \text{V}, \, 0 \, \text{V} < V_{ic} < V_{CC+} - 1.5 \, \text{V}.$

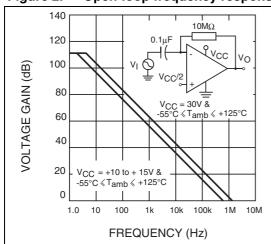
^{2.} The direction of the input current is out of the IC. This current is essentially constant, independent of the state of the output, so there is no change in the loading charge on the input lines.

^{3.} The input common-mode voltage of either input signal voltage should not be allowed to go negative by more than 0.3 V. The upper end of the common-mode voltage range is V_{CC+} -1.5 V, but either or both inputs can go to +32 V without damage.

^{4.} Due to the proximity of external components, ensure that the stray capacitance does not cause coupling between these external parts. This can typically be detected at higher frequencies because this type of capacitance increases.

Figure 2. Open-loop frequency response

Figure 3. Large signal frequency response



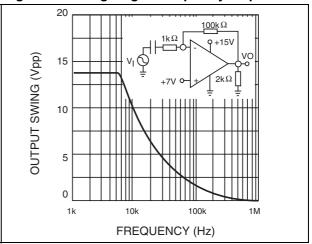
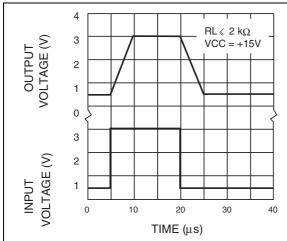


Figure 4. Voltage follower large signal response

Figure 5. Current sinking output characteristics



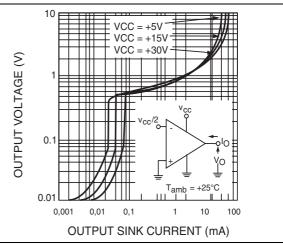
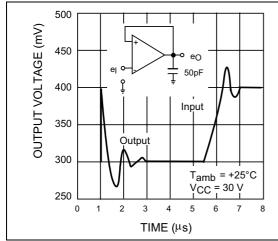
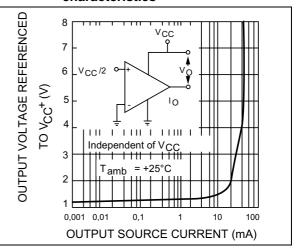


Figure 6. Voltage follower small signal response

Figure 7. Current sourcing output characteristics





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Figure 8. Input current versus temperature

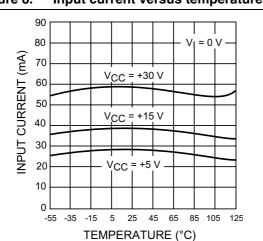


Figure 9. Current limiting

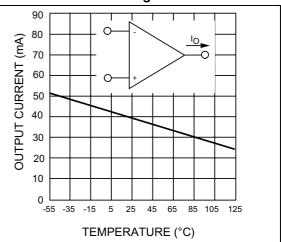


Figure 10. Input voltage range

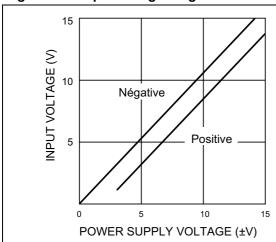


Figure 11. Supply current

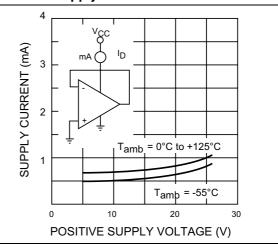


Figure 12. Voltage gain

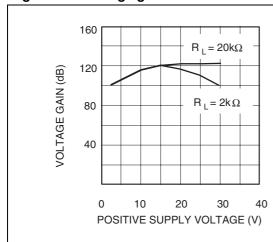


Figure 13. Input current versus supply voltage

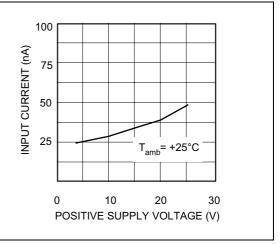
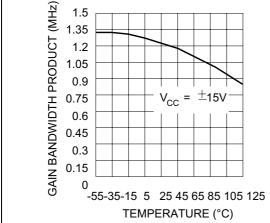


Figure 14. Gain bandwidth product

vidth product Figure 15. Power supply rejection ratio



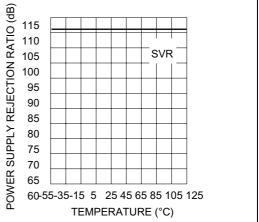
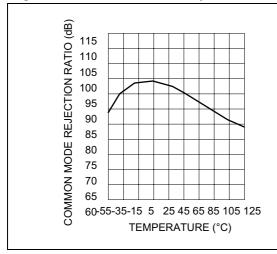
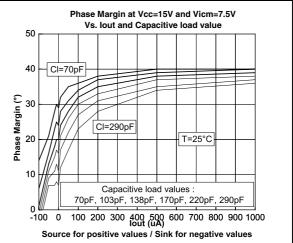


Figure 16. Common-mode rejection ratio

Figure 17. Phase margin vs capacitive load





3.1 Typical single-supply applications

Figure 18. AC coupled inverting amplifier

Figure 19. AC coupled non-inverting amplifier

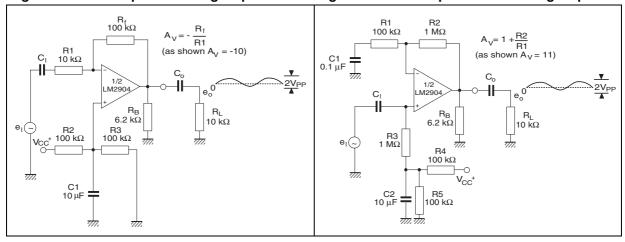


Figure 20. Non-inverting DC gain

Figure 21. DC summing amplifier

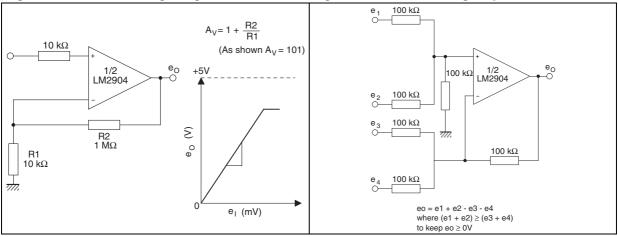


Figure 22. High input Z, DC differential amplifier

Figure 23. Using symmetrical amplifiers to reduce input current

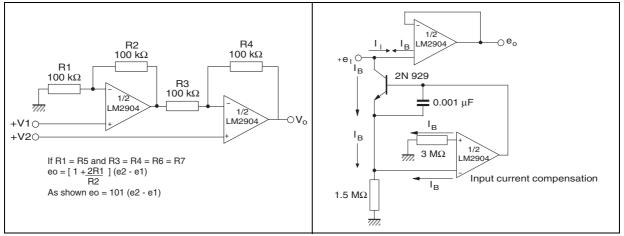
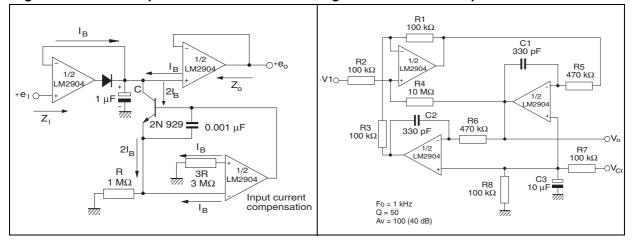


Figure 24. Low drift peak detector

Figure 25. Active bandpass filter



LM2904, LM2904A Macromodel

4 Macromodel

An accurate macromodel of the LM2904 is available on STMicroelectronics' web site at www.st.com. This model is a trade-off between accuracy and complexity (that is, time simulation) of the LM2904 operational amplifier. It emulates the nominal performances of a typical device within the specified operating conditions mentioned in the datasheet. It also helps to validate a design approach and to select the right operational amplifier, but it does not replace on-board measurements.

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5 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK[®] packages, depending on their level of environmental compliance. ECOPACK[®] specifications, grade definitions and product status are available at: www.st.com. ECOPACK[®] is an ST trademark.

LM2904, LM2904A Package information

5.1 DIP8 package information

Figure 26. DIP8 package mechanical drawing

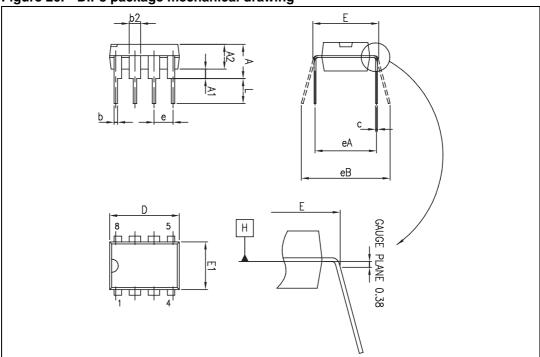


Table 4. DIP8 package mechanical data

| | Dimensions | | | | | | | |
|------|-------------|------|-------|--------|-------|-------|--|--|
| Ref. | Millimeters | | | Inches | | | | |
| | Min. | Тур. | Max. | Min. | Тур. | Max. | | |
| Α | | | 5.33 | | | 0.210 | | |
| A1 | 0.38 | | | 0.015 | | | | |
| A2 | 2.92 | 3.30 | 4.95 | 0.115 | 0.130 | 0.195 | | |
| b | 0.36 | 0.46 | 0.56 | 0.014 | 0.018 | 0.022 | | |
| b2 | 1.14 | 1.52 | 1.78 | 0.045 | 0.060 | 0.070 | | |
| С | 0.20 | 0.25 | 0.36 | 0.008 | 0.010 | 0.014 | | |
| D | 9.02 | 9.27 | 10.16 | 0.355 | 0.365 | 0.400 | | |
| Е | 7.62 | 7.87 | 8.26 | 0.300 | 0.310 | 0.325 | | |
| E1 | 6.10 | 6.35 | 7.11 | 0.240 | 0.250 | 0.280 | | |
| е | | 2.54 | | | 0.100 | | | |
| eA | | 7.62 | | | 0.300 | | | |
| eB | | | 10.92 | | | 0.430 | | |
| L | 2.92 | 3.30 | 3.81 | 0.115 | 0.130 | 0.150 | | |

Package information LM2904, LM2904A

5.2 SO-8 package information

Figure 27. SO-8 package mechanical drawing

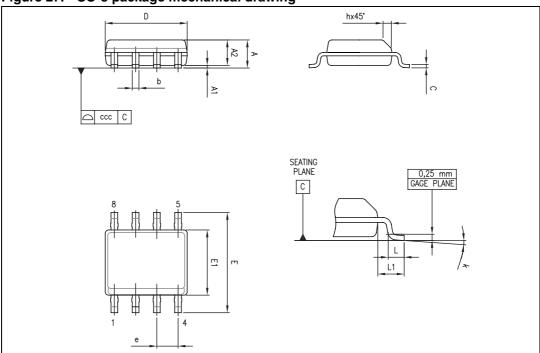


Table 5. SO-8 package mechanical data

| | Dimensions | | | | | | | |
|------|-------------|------|------|--------|-------|-------|--|--|
| Ref. | Millimeters | | | Inches | | | | |
| | Min. | Тур. | Max. | Min. | Тур. | Max. | | |
| Α | | | 1.75 | | | 0.069 | | |
| A1 | 0.10 | | 0.25 | 0.004 | | 0.010 | | |
| A2 | 1.25 | | | 0.049 | | | | |
| b | 0.28 | | 0.48 | 0.011 | | 0.019 | | |
| С | 0.17 | | 0.23 | 0.007 | | 0.010 | | |
| D | 4.80 | 4.90 | 5.00 | 0.189 | 0.193 | 0.197 | | |
| E | 5.80 | 6.00 | 6.20 | 0.228 | 0.236 | 0.244 | | |
| E1 | 3.80 | 3.90 | 4.00 | 0.150 | 0.154 | 0.157 | | |
| е | | 1.27 | | | 0.050 | | | |
| h | 0.25 | | 0.50 | 0.010 | | 0.020 | | |
| L | 0.40 | | 1.27 | 0.016 | | 0.050 | | |
| L1 | | 1.04 | | | 0.040 | | | |
| k | 1° | | 8° | 1° | | 8° | | |
| CCC | | | 0.10 | | | 0.004 | | |

LM2904, LM2904A **Package information**

5.3 DFN8 2 x 2 mm package mechanical data

Figure 28. DFN8 2 x 2 mm package mechanical drawing

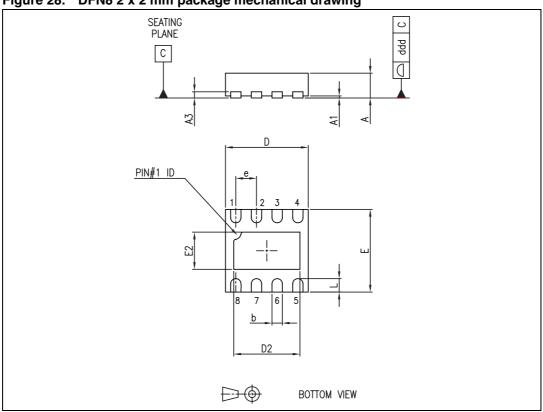


Table 6. DFN8 2 x 2 mm package mechanical data (pitch 0.5 mm)

| | Dimensions | | | | | | | |
|------|------------|-------------|------|-------|--------|-------|--|--|
| Ref. | | Millimeters | | | Inches | | | |
| | Min. | Тур. | Max. | Min. | Тур. | Max. | | |
| Α | 0.51 | 0.55 | 0.60 | 0.020 | 0.022 | 0.024 | | |
| A1 | | | 0.05 | | | 0.002 | | |
| A3 | | 0.15 | | | 0.006 | | | |
| b | 0.18 | 0.25 | 0.30 | 0.007 | 0.010 | 0.012 | | |
| D | 1.85 | 2.00 | 2.15 | 0.073 | 0.079 | 0.085 | | |
| D2 | 1.45 | 1.60 | 1.70 | 0.057 | 0.063 | 0.067 | | |
| E | 1.85 | 2.00 | 2.15 | 0.073 | 0.079 | 0.085 | | |
| E2 | 0.75 | 0.90 | 1.00 | 0.030 | 0.035 | 0.039 | | |
| е | | 0.50 | | | 0.020 | | | |
| L | | | 0.50 | | | 0.020 | | |
| ddd | | | 0.08 | | | 0.003 | | |

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0.45 mm 0.30 mm 0.30 mm

Figure 29. DFN8 2 x 2 mm footprint recommendation

5.4 TSSOP8 package information

Figure 30. TSSOP8 package mechanical drawing

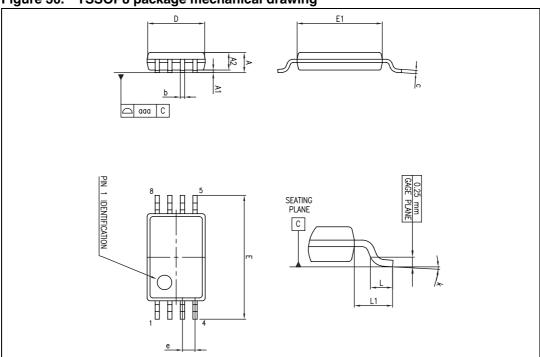


Table 7. TSSOP8 package mechanical data

| | Dimensions | | | | | | | |
|------|------------|-------------|------|-------|--------|-------|--|--|
| Ref. | | Millimeters | | | Inches | | | |
| | Min. | Тур. | Max. | Min. | Тур. | Max. | | |
| Α | | | 1.20 | | | 0.047 | | |
| A1 | 0.05 | | 0.15 | 0.002 | | 0.006 | | |
| A2 | 0.80 | 1.00 | 1.05 | 0.031 | 0.039 | 0.041 | | |
| b | 0.19 | | 0.30 | 0.007 | | 0.012 | | |
| С | 0.09 | | 0.20 | 0.004 | | 0.008 | | |
| D | 2.90 | 3.00 | 3.10 | 0.114 | 0.118 | 0.122 | | |
| E | 6.20 | 6.40 | 6.60 | 0.244 | 0.252 | 0.260 | | |
| E1 | 4.30 | 4.40 | 4.50 | 0.169 | 0.173 | 0.177 | | |
| е | | 0.65 | | | 0.0256 | | | |
| k | 0° | | 8° | 0° | | 8° | | |
| L | 0.45 | 0.60 | 0.75 | 0.018 | 0.024 | 0.030 | | |
| L1 | | 1 | | | 0.039 | | | |
| aaa | | | 0.10 | | | 0.004 | | |

Package information LM2904, LM2904A

5.5 MiniSO-8 package information

Figure 31. MiniSO-8 package mechanical drawing

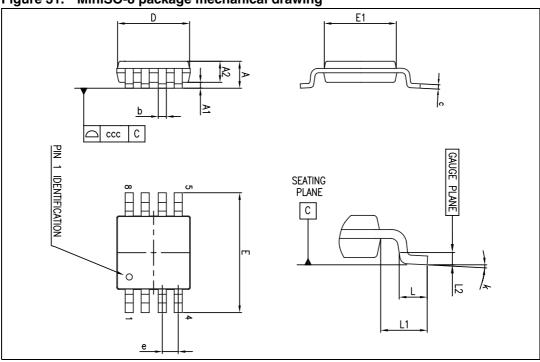


Table 8. MiniSO-8 package mechanical data

| | Dimensions | | | | | | |
|------|-------------|------|------|--------|-------|-------|--|
| Ref. | Millimeters | | | Inches | | | |
| | Min. | Тур. | Max. | Min. | Тур. | Max. | |
| Α | | | 1.1 | | | 0.043 | |
| A1 | 0 | | 0.15 | 0 | | 0.006 | |
| A2 | 0.75 | 0.85 | 0.95 | 0.030 | 0.033 | 0.037 | |
| b | 0.22 | | 0.40 | 0.009 | | 0.016 | |
| С | 0.08 | | 0.23 | 0.003 | | 0.009 | |
| D | 2.80 | 3.00 | 3.20 | 0.11 | 0.118 | 0.126 | |
| Е | 4.65 | 4.90 | 5.15 | 0.183 | 0.193 | 0.203 | |
| E1 | 2.80 | 3.00 | 3.10 | 0.11 | 0.118 | 0.122 | |
| е | | 0.65 | | | 0.026 | | |
| L | 0.40 | 0.60 | 0.80 | 0.016 | 0.024 | 0.031 | |
| L1 | | 0.95 | | | 0.037 | | |
| L2 | | 0.25 | | | 0.010 | | |
| k | 0° | | 8° | 0° | | 8° | |
| ccc | | | 0.10 | | | 0.004 | |

6 Ordering information

Table 9. Order codes

| Order code | Temperature range | Package | Packing | Marking |
|---------------------------|-------------------|--------------------------------------|---------------------|---------|
| LM2904N | | DIP8 | Tube | LM2904N |
| LM2904D/DT | | SO-8 | Tube or tape & reel | 2904 |
| LM2904PT | | TSSOP8 (thin shrink outline package) | Tape & reel | 2904 |
| LM2904ST | | MiniSO-8 | Tape & reel | K403 |
| LM2904Q2T | -40° C to +125° C | DFN8 2 x 2 | Tape & reel | K1Y |
| LM2904YDT ⁽¹⁾ | | SO-8 | Tana 9 raal | 2904Y |
| LM2904AYDT ⁽¹⁾ | | (automotive grade level) | Tape & reel | 2904AY |
| LM2904YPT ⁽²⁾ | | TSSOP8 | Topo 9 rool | 2904Y |
| LM2904AYPT ⁽²⁾ | | (automotive grade level) | Tape & reel | 2904AY |
| LM2904YST ⁽¹⁾ | | MiniSO-8 (automotive grade level) | Tape & reel | K409 |

Qualified and characterized according to AEC Q100 and Q003 or equivalent, advanced screening according to AEC Q001 & Q 002 or equivalent.

^{2.} Qualification and characterization according to AEC Q100 and Q003 or equivalent, advanced screening according to AEC Q001 & Q 002 or equivalent are on-going.

Revision history LM2904, LM2904A

7 Revision history

Table 10. Document revision history

| Date | Revision | Changes |
|----------------|----------|---|
| 02-Jan-2002 | 1 | Initial release. |
| 20-Jun-2005 | 2 | PPAP references inserted in the datasheet, see <i>Table 9 on page 21</i> . ESD protection inserted in <i>Table 1 on page 4</i> . |
| 10-Oct-2005 | 3 | PPAP part numbers added in table Table 9 on page 21. |
| 12-Dec-2005 | 4 | Pin connections identification added on cover page figure. Thermal resistance junction to case information added see <i>Table 1 on page 4</i> . |
| 01-Feb-2006 | 5 | Maximum junction temperature parameter added in Table 1 on page 4. |
| 02-May-2006 | 6 | Minimum slew rate parameter in temperature Table 3 on page 6. |
| 13-Jul-2006 | 7 | Modified ESD values and added explanation on V _{CC} , V _{id} in <i>Table 1 on page 4</i> . Added macromodel information. |
| 28-Feb-2007 | 8 | Modified ESD/HBM values in <i>Table 1 on page 4</i> . Updated MiniSO-8 package information. Added note relative to automotive grade level part numbers in <i>Table 9 on page 21</i> . |
| 18-Jun-2007 | 9 | Power dissipation value corrected in <i>Table 1: Absolute maximum ratings</i> . <i>Table 2: Operating conditions</i> added. Equivalent input noise voltage parameter added in <i>Table 3</i> . Electrical characteristics curves updated. <i>Figure 17: Phase margin vs capacitive load</i> added. <i>Section 5: Package information</i> updated. |
| 18-Dec-2007 10 | | Removed power dissipation parameter from <i>Table 1: Absolute maximum ratings</i> . Removed V _{opp} from electrical characteristics in <i>Table 3</i> . Corrected MiniSO-8 package mechanical data in <i>Section 5.5: MiniSO-8 package information</i> . |
| 08-Apr-2008 | 11 | Added table of contents. Corrected the scale of <i>Figure 5</i> (mA not μA). Corrected SO-8 package information. |
| 02-Jun-2009 | 12 | Added input current information in <i>Table 1: Absolute maximum ratings</i> . Added L1 parameters in <i>Table 5: SO-8 package mechanical data</i> . Added new order codes, LM2904AYD/DT, LM2904AYPT and LM2904AYST in <i>Table 9: Order codes</i> . |

LM2904, LM2904A Revision history

Table 10. Document revision history (continued)

| Date | Revision | Changes |
|-------------|----------|---|
| 13-Apr-2010 | 13 | Added LM2904A on cover page. Corrected footnote (5) in <i>Table 1: Absolute maximum ratings</i> . Removed order code LM2904AYST from <i>Table 9: Order codes</i> . |
| 24-Jan-2012 | 14 | Removed macromodel from <i>Chapter 4</i> (now available on <i>www.st.com</i>). Added DFN8 2 x 2 mm package information in <i>Chapter 5</i> and related order codes in <i>Chapter 6</i> . Removed LM2904YD and LM2904AYD order codes from <i>Table 9</i> . Changed note for LM2904YST order code in <i>Table 9</i> . |

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